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AUTHOR Sturm, Deborah; Moroh, Marsha
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ABSTRACT

Although women typically do as well as or better than men in the introductory computer science course at City University of New York's College of Staten Island, relatively few women even attempt it. This paper is an analysis of the transcripts of five years of computer science majors (n=626; 449 men, 177 women) at that institution. Data reveals that women are doing as well as men throughout the computer science curriculum and are outperforming them at every level of mathematics. Yet a survey of current students showed that both sexes believe that men surpass women in calculus. It is hoped that publication of this data concerning women's mathematical success and aptitude in various media will prove instrumental in persuading women to enter and remain in the computer science field. (Contains 19 references.) (Author/BEW)

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Gender and Computer Science Majors: Perceptions and Reality

Paper presented at the NECC '95, the Annual National Educational Computing Conference (16th, Baltimore, MD, June 17-19, 1995.

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Gender and Computer Science Majors: Perceptions and Reality

Deborah Sturm
Department of Computer Science
College of Staten Island (City University of New York)
2800 Victory Boulevard
Staten Island, NY 10314
(718) 982-2848
ddssi@cunyvm.cuny.edu

Marsha Moroh
Department of Computer Science
College of Staten Island (City University of New York)
2800 Victory Boulevard
Staten Island, NY 10314
(718) 982-2846
mamsi@cunyvm.cuny.edu

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Abstract

Although women do as well as or better than men in our introductory computer science course, relatively few women even attempt the first course. We recently analyzed the transcripts of all computer science majors over the past five years in an attempt to determine why. We confirmed that women are doing as well as men throughout our curriculum. Moreover we found that women out-perform men at every level of mathematics we studied. A survey of our current students revealed that both men and women believe that men surpass women in calculus. We present some strategies to correct that misconception, in the hope that it will encourage women to enter and remain in computer science.

Introduction

It is well known that the percentage of women in the computer science field is small, and dropping, particularly in academia [GM91]. Although the discrepancies are widest at the Ph.D. level, the gender gap has been shown to appear even before college. This phenomenon is particularly distressing because it is unrelated to competence in the field.

Low self-confidence among women concerning their ability to do science is common in women who switch out of science engineering and mathematics (SEM). Moreover, studies have shown that it is independent of the women's actual level of performance [SE93]. Other studies [WD86],[SH94] found that the strongest difference between male and female science students is in their level of self-confidence.

A study of graduate students cited by L.E. Moses found "... 30% of the women vs. 15% of the men questioned their ability to handle the work; 33% of the women versus 9% of the men feared that speaking up would reveal their inadequacies [ME93]." Other studies [TC91], [WS85] found that men had more confidence in their academic ability. While men blamed failure on poor teaching or difficult material, women tended to blame their own perceived lack of ability.

Our Study

At our own college, a study [SM94] of performance in our introductory computer science course showed that the percentage of women passing the course is higher than that of the men. Yet we found an alarming drop in the already low number of women majors over a period of several semesters. At the beginning of the study, in the fall of 1990, 25% of our majors were women. The percentage steadily dropped until it was 18% by the spring of 1992.

As part of our study we examined the transcripts of 626 computer science majors (449 men and 177 women) over a period of five years. The following factors were considered:

- The number and gender of students who switched from a major in computer science.
- Grade point averages.
- A breakdown of grades in basic computer science courses.
- A breakdown of grades in pre-calculus and calculus.

The average grade point average for women was 2.8 (out of 4.0) whereas for men it was 2.58. In addition, 44% of the women had a B or better average, as compared with 34% of the men. It is noteworthy that, in all but one computer science course, the women performed almost exactly the same as the men. Moreover, their completion rate was higher in all courses. When the switching occurred, it was between semesters, not in the middle of a course. The women were switchers, not dropouts (In Table 1 note the unsuccessful completion rate).

Despite the fact that the women do as well or better in computer science and mathematics than men, their persistence is significantly lower. We found that 44% of the women changed their major from computer science whereas only 29% of the men switched. This follows a national trend where women switch at a much higher rate than men from majors in science, engineering and mathematics [SH94]. In our department the drop usually takes place earlier than mid-major; many of the women never go beyond the introductory course.

Women and Mathematics–Real, and Perceived Achievement

We found that women did significantly better in all pre-calculus and calculus courses. For example in pre-calculus, 27% of the women received an A as compared to 17% of the men. In third level calculus, 25% of the women attained an A while only 16% of the men did. Results for representative courses are shown in Table 1.

Despite this, female students often expressed doubt in their ability to handle the mathematics associated with the computer science degree, and cited this as a reason for avoiding the computer science major. The mathematics requirement for our computer science degree is substantial, and includes 3 terms of calculus, 2 terms of discrete mathematics, linear algebra, and probability.

Table 1: Summary of transcript information for a representative sample of computer science and math courses

Introductory Computer Science

Grades	Number Women	Percent Women	Number Men	Percent Men
A	38	37.62	112	38.62
B	26	25.74	62	21.37
C	16	15.84	41	14.13
D	5	4.95	6	2.06
Unsuccessful Completion	16	15.84	69	23.79
Total	101		290	

Assembler Programming

Grades	Number Women	Percent Women	Number Men	Percent Men
A	42	45.16	124	39.87
B	25	26.88	84	27.00
C	17	18.27	39	12.54
D	3	3.22	20	6.43
Unsuccessful Completion	6	6.45	44	14.14
Total	93		311	

Pre-Calculus

Grades	Number Women	Percent Women	Number Men	Percent Men
A	18	27.27	29	17.26
B	13	19.69	33	19.64
C	14	21.21	37	22.02
D	7	10.60	16	9.52
Unsuccessful Completion	14	21.21	53	31.54
Total	66		168	

Advanced Calculus

Grades	Number Women	Percent Women	Number Men	Percent Men
A	18	25.35	36	16.07
B	18	25.35	46	20.53
C	14	19.71	64	28.12
D	5	7.04	25	11.16
Unsuccessful Completion	16	22.53	54	24.10
Total	71		224	

This semester we surveyed ten computer science classes to assess their perceptions about gender and math ability. Approximately 200 students participated in the survey. A majority of men (75%) felt that men perform better in calculus than women. Only a third of the women thought that women do better. Women also seemed more conflicted over the question of

who excels in mathematics. Nearly one quarter answered ambiguously, either leaving the question blank or checking both genders. On the other hand, men almost uniformly gave one choice. Complete results are shown in Table 2.

Table 2: Results of Survey Assessing Perceptions about Math Ability

Gender of Those Surveyed	% and Number Who Answered Men Better in Calculus		% and Number Who Answered Women Better in Calculus		Ambiguous Answer	
Men	75 %	109	12 %	18	13 %	19
Women	43 %	20	33 %	15	24 %	11

It is our expectation that reporting studies relating to women's performance in mathematics will help reverse the trend of switching from SEM. We plan to disseminate this information concerning women's competence in mathematics in various ways. Locally, in our Women in Computer Science Club, we will publicize the mathematics achievement rates for women, in the hope that this will dispel the myth of the women's inferiority in mathematics. Nationally, we will use Internet facilities to disseminate the information on the World Wide Web. We will create a home page on the CUNY Web server that will provide access to project data and results.

Our hope is that by making these facts more widely available we can close the gap between perception and reality and thereby influence more women to enter and remain in computer science.

References

[A92] AAUW Educational Foundation, *The AAUW report,: How schools shortchange girls*. American Association of University Women (AAUW), 1992.

[A91] ACM Computing Curricula 1991, *A Summary of the CM/IEEE-CS joint curriculum task force report*. Communications of the ACM, 34(6), pp. 68-84, June, 1991.

[C93] Computing professionals, changing needs for the 90's. A workshop report, National Research Council, National Academy Press, 1993.

[GY93] George, Yolanda S., Malcolm, Shirley M., Jeffers, Laura, *Computer equity for the future*, Communications of the ACM, Vol. 36, Number 5, May 1993.

[GM90] Gries, David and Marsh, Dorothy. *The 1988-89 Taulbee Survey Report*, Comm. of the ACM, Vol. 33, No. 9, Sept. 1990, pp. 160-169.

[H93] Hafner, Katie, *Woman, computer nerd–and proud*, New York Times, Section 3, page 1, August 29, 1993.

[HA93] Hanchey, Cindy Meyer, *Labs, learning styles, and gender*, Proceedings National Educational Computing Conference (NECC), June, 1993.

[HO93] Howell, K., "The Experience of Women in Undergraduate Computer Science: What Does the Research Say?", SIGCSE Bulletin, Vol. 25 No. 2 June 1993

[L90] Leveson, Nancy G., *Educational Pipeline Issues for Women*, Computing Research Association, July, 1990.

[M90] Martin, C. Diane, *In Search of Gender-Free Paradigms for Computer Science Education*, Computing Research News, October, 1990.

[M93] Moses, L.E., *Our computer science classrooms. Are they friendly to female students?*, ACM SIGCSE Bulletin, Vol. 25, Number 3, September, 1993.

[OR93] O'Rourke, Joseph, *Mentoring project targets female undergrads*, Computing Research News, Vol. 5/No. 4, September, 1993.

[PP90] Pearl, Amy, Pollack, Martha E., Riskin, Eve, Thomas, Becky, Wolf, Elizabeth and Wu, Alice. *Becoming a Computer Scientist: A report by the ACM committee on the status of women in Computing Science*. Comm. of the ACM, Vol. 33, No. 11, Nov. 1990, pp. 47-57.

[SH94] Seymour, E. and Hewitt, N, *Talking About Leaving: Factors Contributing to High Attrition Rates Among Science, Mathematics and Engineering Undergraduate Majors*, Final Report to the Alfred P. Sloan Foundation on an Ethnographic Inquiry at Seven Institutions, April 1994.

[SE93] Strenta, C., Elliot, R., Matier, M., Scott, J., & Adair, R., *Choosing and Leaving Science in Highly Selective Institutions: General Factors and the Question of Gender*, Report to the Alfred P. Sloan Foundation, 1993.

[SM94] Sturm, D. and Moroh, M., *Encouraging Enrollment and Retention of Women in Computer Science Classes*, Proceedings of NECC '94, June 1994, pp. 267-271.

[TC91] Teague, J., and Clarke, V., *Fiction and Fact: Students' and Professionals' Perceptions of Women in Computer Science, Proceedings of the Conference on Women*, Work and Computerization, Helsinki: Ministry of Social Affairs and Health, pp. 377-390.

[WD86] Ware, N., and Dill, D., *Persistence in Science Among Mathematically Able Male and Female College Students with Pre-College Plans for a Scientific Major*, presented at the Annual Meeting of the American Educational Research Association, 1986.

[WS85] Ware, N., Steckler, N., and Leserman, J., *Undergraduate Women: Who chooses a Science Major?*, Journal of Higher Education, 56(1), 1985, 73-84.

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